

DACA42-03-C-0024



**Ft Belvoir PEM Demonstration Project
Final Report**

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement **CERL-BAA-FY02**

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**Fort Belvoir Fire Station, Building 191
Fort Belvoir, Virginia**

May 10, 2007

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Executive Summary

Under terms of its FY'02 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy installed a Plug Power GenSys5C 5kWe Combined Heat and Power fuel cell power plant for one year at the South Post Fire Station Building 191 at Fort Belvoir Army Base, Virginia, near Washington, DC. This project is one of two Fort Belvoir sites originally awarded to LOGAN, however the second site encountered frustrations due to personnel changes on the base, which has caused LOGAN to seek opportunities elsewhere.

The South Post Fire Station fuel cell is electrically configured to provide grid parallel/grid independent service to the facility and it is also thermally integrated with its gas-fired water heater to support domestic thermal loads. Local electrical and mechanical contractors were hired as necessary to provide services needed to support the installation tasks. It is anticipated that the project will add \$633.37 in annual energy costs to Fort Belvoir during the period of performance.

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

LOGANEnergy Corp. Small Scale PEM 2002 Demonstration Project located at the Post Fire Station Bldg. 191 at Fort Belvoir Army Base, Virginia, near Washington, DC.

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
770-650-6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 9 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCore 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Vincent Cassala is the Plug Power point of contact for this project. His phone number is 518-782-7700 ext. 1228, and his email address is Vincent_cassala@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Chris Davis
Title	President	Vice President Operations
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770-650-6388 ext. 101	860-872-1120
Fax	770-650-7317	770-650-7317
Email	samlogan@loganenergy.com	cdavis@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Chris Davis
Title	President	Vice President Operations
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770-650-6388 ext. 101	860-872-1120
Fax	770-650-7317	770-650-7317
Email	samlogan@loganenergy.com	cdavis@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
732-594-1686

In November 2002, Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability. LOGAN performs the quarterly and annual service prescribed by the UTC, and performs other maintenance as required. The periods of unavailability are chiefly due to persistent inverter problems that seem to be endemic to the Toshiba power conditioning balance of the system. Field modifications and operating adjustments have largely cured the problem. Quarterly service events take 10 hours to complete with the unit under load, and the annual event takes approximately 35 hours with the unit shut down.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD.

Plug Power
Mr. Scott Wilshire.
968 Albany Shaker Rd.
Latham, NY 12110
518-782-7700 ext. 1338

LOGAN performed the start-up of both units after Southern Maryland Electric Cooperative completed most of the installation work. The units are located at residential sites at Patuxant River Naval Air Station, MD and operate in standard grid connected/grid independent

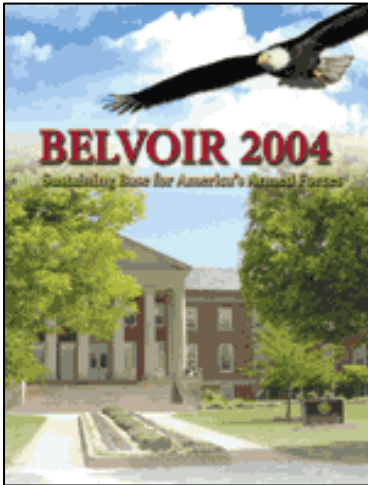
configurations. Both operate at 4.5kWe and have maintained 98% availability. The units, S/Ns 241 and 242 are two of the very latest GenSys models to reach the field. S/N 242 is Plug Power's first LPG fueled system to go into the field. Both have set new performance standards, and raised expectations for near term commercial viability for this product. Operations to date are indicative of the success of the various test and evaluation programs that have been conducted over the past two years.

- c) Contract: A Partners LLC; Commercial PC25 Fuel Cell Project Design, Installation and 5-year service and maintenance agreement.

Mr. Ron Allison
A Partners LLC
1171 Fulton Mall
Fresno, CA 93721
559-233-3262

On April 20, 2004 LOGAN completed the installation of a 600kWe PC25C CHP fuel cell installation in Fresno, CA. The system operating configurations allow for both grid parallel and grid independent energy service. The grid independent system is integrated with a Multi Unit Load Sharing (MULS) electronics package and static switch, which initial development was funded by ERDC CERL in 1999. This is the third fuel cell installation that uses the MULS System. The thermal recovery package installed in the project includes a 100-ton chiller that captures 210 °F thermal energy supplied by the three fuel cells to support cooling loads on the first three floors of the host facility. The fuel cells also provide low-grade waste heat at 140 °F that furnishes thermal energy to 98 water source heat pumps located throughout the 12-story building during the winter months.

7.0 Host Facility Information



Historic Fort Belvoir is a beautiful installation with a unique and complex history. At first glance it may appear to be a typical US military post, but closer inspection reveals a thoroughly modern American city with new and improved roads and buildings, a growing number of organizations that call Fort Belvoir "home", more civilian employees, and far fewer soldiers-in-training than at any other time in our proud history.

However, Fort Belvoir's military mission is global. As a strategic sustaining base for America's Army, the work it does is vital to the success of the goals and objectives of the nation's defense strategy.

A list of the nearly 100 tenant organizations that call Fort Belvoir home reads like a "Who's Who" of the Department of Defense. No other Army installation in the world can

compare to Fort Belvoir and its singular mission to provide both logistical and administrative support to such a diverse mix of tenant and satellite organizations.

Fort Belvoir is home to one Army major command headquarters and elements of 10 others, 19 different agencies and direct reporting units of the Department of Army, eight elements of the US Army Reserve and the Army National Guard, and 26 DOD agencies. Also located here are a Marine Corps detachment, a US Air Force activity, and an agency from the Department of the Treasury.

8.0 Fuel Cell Installation



Figure 1. Fort Belvoir Fire Station



Figure 2. Fuel Cell Pad Site



Figure 3. Fuel Cell Installed on Pad Site

Pictured at left in [Figure 1](#) is the front elevation of the Fort Belvoir Fire Station (South Post) Building 191, the site for this PEM demonstration project. Because the building is listed on the national historic registry, the project was delayed for nearly four months in order to gain approval from the base architect. However, on September 17, 2004, the project moved forward as a site evaluation team consisting of Bill Taylor (representing CERL), Mike Harvell and Keith Spitznagel of LOGAN, and several representatives of Fort Belvoir DPW together with the station fire chief toured the fire station. Following that, the team agreed that the site would serve the demonstration very well. On March 10, 2005, GenSys SN#323 was commissioned for operation.

[Figure 2](#) shows the fuel cell pad site, supporting an inoperative air conditioning compressor, as it appeared during the site evaluation. The photo shows the Plug Power GenSys5C (See appendix section 2 for specifications) fuel cell situated on the same pad after removing the compressor unit. The same photo also shows the natural gas meter serving the building, which provides the fuel supply to the fuel cell. The building did not originally have high speed Ethernet service, but the project POC offered assistance in acquiring the service.

In [Figure 3](#) the GenSys5C, installed on the pad previously occupied by an inoperable A/C unit, is shown. The gray boxes on the right side of the fuel cell are the electric meter and emergency disconnect switch. A more detailed picture of the installed components can be seen in [Figure 4](#).

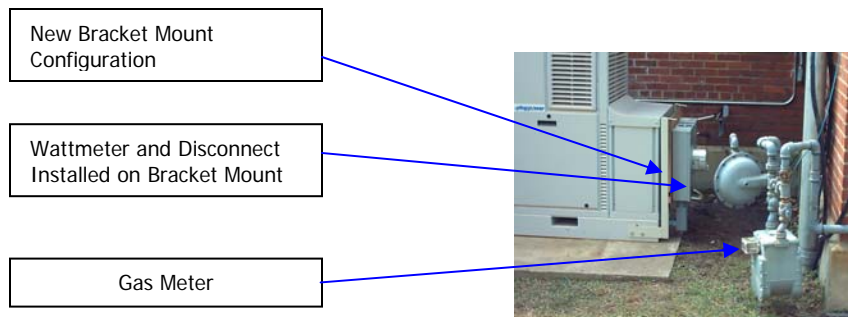


Figure 4. Gas Meter and Electric Meter/Disconnects Close-Up

9.0 Electrical System

The Plug Power GenSys 5C PEM fuel cell power plant provided both grid parallel and grid independent operating configurations for site power management. This capability was an important milestone in the development of the GenSys5 as it approaches product commercialization. The unit has a power output of 110/120 VAC at 60 Hz, and when necessary the voltage can be adjusted to 208 VAC or 220 VAC depending upon actual site conditions. At this site, the unit was connected to the facility in a grid parallel/grid independent configuration, dispatching power at 2.5 kW for most of the period of performance. Figure 4 shows a close-up of the new fuel cell electrical interconnect configuration that LOGAN tested for the first time at this site. Note the new base plate and bracket that attaches the wattmeter and service disconnect directly to the fuel cell. This improvement makes for a more cost effective installation and simplifies the service and maintenance of the unit.

The fuel cell was configured to operate in both a grid parallel/grid independent electrical configuration and connected to the building main panel located on the interior wall directly behind the unit. There the fuel cell was electrically coupled to the base utility grid at a spare 50-amp circuit breaker cubicle. A separate emergency panel was installed adjacent to this service panel to provide stand-by power for several non-critical loads in the event of a grid failure during the test period. This provided the opportunity to demonstrate the fuel cell's grid independent capability.

10.0 Thermal Recovery System

LOGAN installed a Heliodyne heat exchanger to capture fuel cell waste heat and transfer it into the fire station's hot water heater. The Heliodyne is a looped coil-within-coil design that provides double-wall protection between the heat source and the heat sink. It was designed primarily for the solar heating industry, but has proved to be very adaptable to the fuel cell industry, as LOGAN has used this product effectively at several other PEM demonstration sites. At the Fort Belvoir fire station, the Heliodyne was mounted directly to the storage tank as seen in [Figure 5](#). It had its own pump that circulated the storage tank in a counter flow against incoming hot water provided by a thermal loop exchanger connected to the fuel cell's heat exchanger. While operating at a set point of 2.5 kWh, the fuel cell had a heat rate of approximately 7800 Btu/h through the Heliodyne up to the hot water tank.



Figure 5. Heliodyne Thermal Recovery Set

11.0 Data Acquisition System

LOGAN installed a Connected Energy Corporation web based SCADA system that provided high-speed access to real time monitoring of the power plant. The schematic drawing seen in [Figure 6](#) describes the architecture of the CEC hardware that supported the project. The system provided a comprehensive data acquisition solution and also incorporated remote control, alarming, notification, and reporting functions. The system monitored and displayed a number of fuel cell operating parameters on functional display screens including kWh, cell stack voltage, and water management, as well as external instrumentation inputs including Btus, fuel flow, and thermal loop temperatures. CEC's Operations Control Center in Rochester, New York maintained connectivity by means of a Virtual Private Network that linked the fuel cell to the center.

Examples of the Connected Energy web based data collection system can be seen in the display shown in [Figure-7](#).

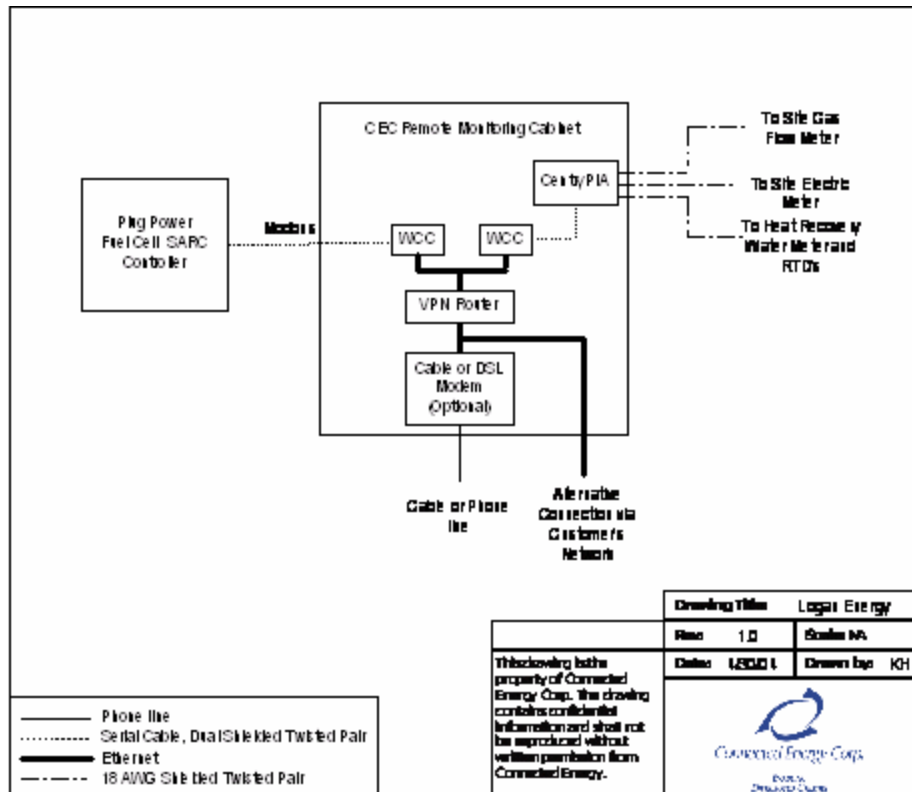


Figure 6. CEC WEB enabled SCADA terminal hardware and architecture detail.

LOGAN procured high-speed Internet access to the fuel cell router from a local DSL service provider with the help of the Fort Belvoir POC, as mentioned above. The base provided a local dial tone to a phone jack that was conveniently located in the electric closet of Building 191 to provide communications with the fuel cell data modem. For access to the demonstration data use the following link and select Fort Belvoir once at the Connected Energy site.

www.enerview.com

User: Logan.user
Password: guest

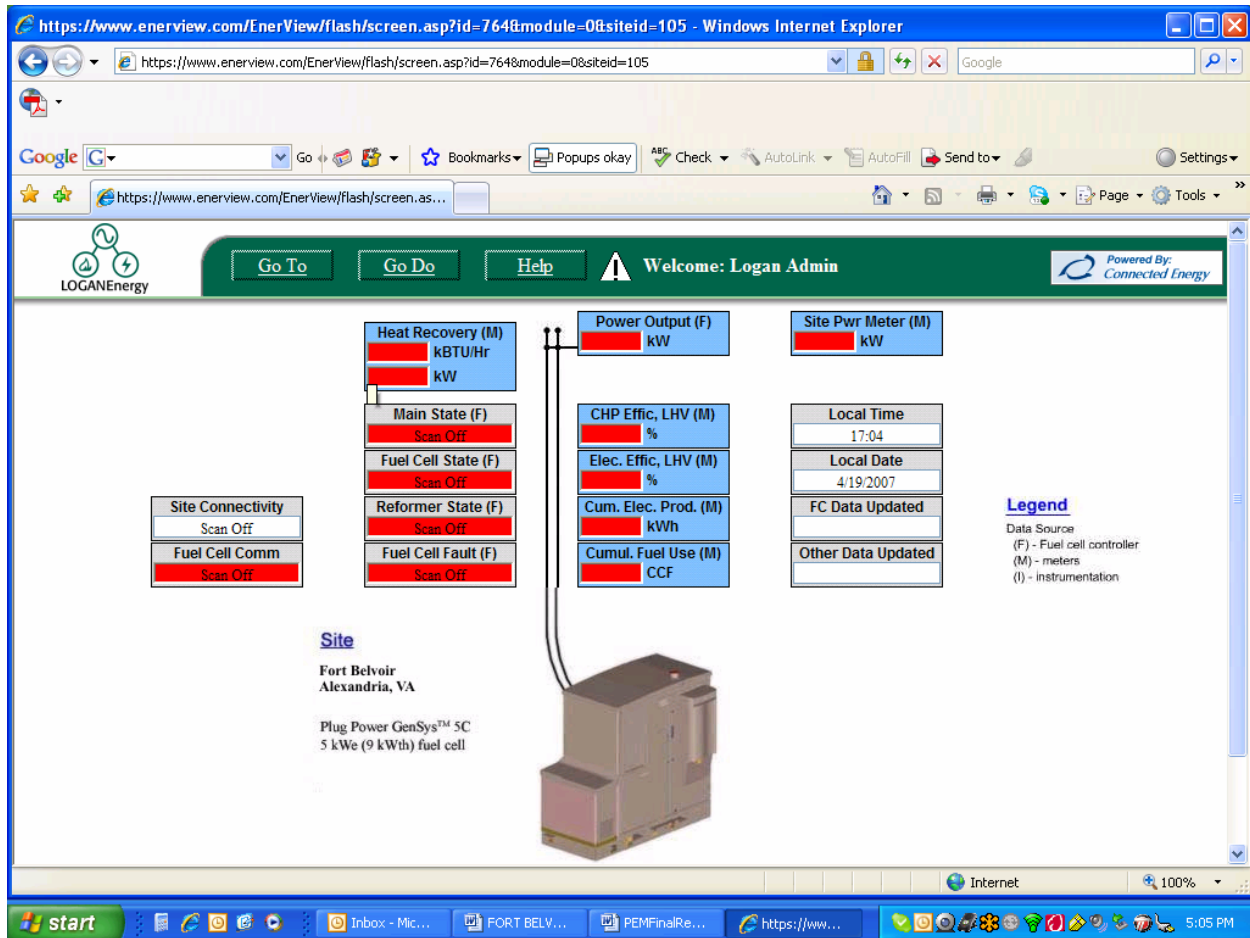


Figure 7. Connected Energy Web Based Data Collection System Display

12.0 Fuel Supply System

LOGAN connected the fuel cell gas piping into the existing natural gas service line adjacent to the fuel cell pad, and installed a flow meter to calculate fuel cell usage, as indicated in Figure 4. A regulator at the fuel cell gas inlet maintained the correct fuel cell operating pressure at 14 inches water column. During the test period there was a shutdown in September 2005 where the stack exhibited poor performance on restart. It was believed that this was due to poor gas being delivered by the reformer.

13.0 Installation Costs

Fort Belvoir Fire Station Building 191

Project Utility Rates		Utility
1) Water (per 1,000 gallons)	\$0.450	
2) Utility (per KWH)	\$0.053	Virginia Power
3) Natural Gas (per MCF)	\$7.25	Washington Gas

First Cost	Estimated	Actual	Variance
Plug Power 5 kW GenSys5C	\$ 65,000.00	\$ 65,000.00	\$ -
Shipping	\$ 2,800.00	\$ 1,727.00	\$ (1,073.00)
Installation electrical	\$ 2,275.00	\$ 5,008.35	\$ 2,733.35
Installation mechanical & thermal	\$ 6,215.00	\$ 5,704.92	\$ (510.09)
Watt Meter, Instrumentation, Web Package	\$ 11,830.00	\$ 9,098.00	\$ (2,732.00)
Site Prep, labor materials	\$ 1,775.00	\$ 790.00	\$ (985.00)
Technical Supervision/Start-up	\$ 4,000.00	\$ 5,464.00	\$ 1,464.00
Total	\$ 93,895.00	\$ 92,792.26	\$ (1,102.74)

Assume Five Year Simple Payback		\$ 18,779.00	\$ 18,558.45
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Forecast Operating Expenses	Volume	\$/Hr	\$/ Yr
Natural Gas MCF/ hr @ 2.5kW	0.033	\$ 0.24	\$ 1,876.99
Water Gallons per Year	14,016		\$ 6.31
Total Annual Operating Cost			\$ 1,883.29

Economic Summary		
Forecast Annual kWh		19710
Annual Cost of Operating Power Plant	\$	0.096 kWh
Credit Thermal Recovery Rate		(\$0.011) kWh
Project Net Operating Cost	\$	0.085 kWh
Displaced Utility cost	\$	0.053 kWh

Energy Savings (Cost)	(\$0.032) kWh
Annual Energy Savings (Cost)	(\$633.37)

Explanation of Calculations:

Actual First Cost Total is a *sum* of all the listed first cost components.

Assumed Five Year Simple Payback is the Estimated First Cost Total *divided by* 5 years.

Forecast Operating Expenses:

Natural gas usage in a fuel cell system set at 2.5 kW will consume 0.033 MCF per hour. The cost per hour is 0.033 Mcf per hour \times the cost of natural gas to the site per MCF at \$7.25. The cost per year at \$1,876.99 is the cost per hour at \$0.24 \times 8760 hours per year \times 0.9. The 0.9 is for 90% availability.

Natural gas fuel cell systems set at 2.5 kW will consume 1.6 gallons of water per hour through the DI panel. The total volume of water consumed at 14,016 gallons per year is 1.6 gph \times 8760 hours per year. The cost per year at \$6.31 is 14,016 gph \times cost of water to the site at \$0.43 per 1000 gallons.

The Total Annual Operating Cost, \$1883.29 is the *sum of* the cost per year for the natural gas and the cost per year for the water consumption.

Economic Summary:

The Forecast Annual kWh at 19,710 kWh is the product of 2.5 kW set-point for the fuel cell system \times 8760 hours per year \times 0.9. The 0.9 is for 90% availability.

The Annual Cost of Operating the Power Plant at \$0.096 per kWh is the Total Annual Operating Cost at \$1883.29 *divided by* the forecast annual kWh at 19,710 kWh.

The Credit Annual Thermal Recovery at -\$0.011 is 7800 *divided by* 3414. This is then *multiplied by* 0.9 \times 0.1 \times the cost of electricity at \$0.0530 per kWh \times (-1). As a credit to the cost summary, the value is expressed as a negative number.

The Project Net Operating Cost is the *sum* of the Annual Cost of Operating the Power Plant *plus* the Credit Annual Thermal Recovery.

The Displaced Utility Cost is the cost of electricity to Fort Belvoir per kWh.

Energy Savings (cost) equals the Displaced Utility Cost *minus* the Project Net Operating Cost.

Annual Energy Savings (cost) equals the Energy Savings \times the Forecast Annual kWh.

14.0 Acceptance Test

An 8-hour acceptance test was run on March 11, 2005 by the technician following completion of all the commissioning tasks listed in the Checklist attached below. It was the first successful start-up of the system.

Installation/Acceptance Test Report

Site: Fort Belvoir Fire Station, Fort Belvoir, Virginia

Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	JW	9/28/04	2
Stack Installed	JW	9/28/04	3
Stack Coolant Installed	JW	9/28/04	1
Air Purged from Stack Coolant	JW	9/28/04	2
Radiator Coolant Installed	JW	9/30/04	3
Air Purged from Radiator Coolant	JW	9/30/04	1
J3 Cable Installed	JW	9/29/04	1
J3 Cable Wiring Tested	JW	9/29/04	0.5
Inverter Power Cable Installed	JW	10/04/04	0.5
Inverter Power Polarity Correct	JW	10/04/04	0.5
RS 232 /Modem Cable Installed	JW	9/29/04	0.5
DI Solenoid Cable Installed with Diode	JW	9/28/04	0.5
Natural Gas Pipe Installed	JW	9/29/04	8
DI Water / Heat Trace Installed	JW	9/28/04	4
Drain Tubing Installed	JW	9/28/04	1

Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	JW	3/10/05	4
SARC Name Correct	JW	3/10/05	1
Start-Up Initiated	JW	3/10/05	6
Coolant Leak Checked	JW	3/10/05	1
Flammable Gas Leak Checked	JW	3/10/05	1
Data Logging to Central Computer	JW	3/10/05	2
System Run for 8 Hours with No Failures	JW	3/11/05	8

15.0 Decommissioning

Decommissioning and restoration of the site took place on April 27, 2007 and required 35 man-hours to complete. The decommissioning process included draining the fuel cell stack & system coolant. The ILS catalyst & desulphurizer canister was removed for hazmat shipping. All utilities were disconnected including communication and heat recovery connections. The Connected Energy box was removed along with the water treatment panel. All piping was removed and the trench's were filled back in. Finally, the site was inspected to make sure it was returned to its original condition. Unfortunately, no post demonstration photos were captured indicating the final site condition

16.0 Additional Research / Analysis

LOGAN performed a series of harmonics tests on the unit under normal operations using an Amprobe HarmonaLink 2 testing device; the results of this testing are presented in Appendix Section 3. The data describes two test conditions; a.) stand alone grid harmonics, and b.) the inverter harmonics in a grid connected configuration at 2.2kW.

The IEEE Standard, 519-1992, that governs the performance of the Plug Power states that

1. Total Voltage Harmonic Distortion at rated inverter output is limited to 5% of fundamental frequency voltage, and
2. Individual Frequency Harmonics Distortion is limited to 3% of fundamental frequency voltage.

Referring to the Charts in Appendix 3, the test results indicate that at the time the measurements were taken, no individual Frequency Harmonic exceeded the IEEE standard of 3%, and that total Voltage Harmonic Distortion at 3.4% was well below the upper IEEE limit of 5%.

17.0 Conclusions/ Summary

This project had a very strong partner in the Fort Belvoir Environmental & Natural Resource Division led by our POC Chief Patrick McLaughlin. The installation received great support as a high profile technology demonstration on the base. The Fort Belvoir fuel cell demonstration ran for 17 months since its commissioning on March 11, 2005. During the demonstration, the system ran at an overall availability of 85% and during the 12 good months of running time the system availability reached 92% meeting the CERL availability requirement. The unit officially completed the one year demonstration in June 2006 but continued operating through a portion of July before shutting down for the final time. Even though the travel time and distance to support this unit was a challenge, in many respects it stimulated better resource planning and parts supply. This project also enhanced LOGAN's capabilities around project planning for distant operations, remote monitoring and troubleshooting and therefore it contributed to a more rapid expansion of the company's fuel cell knowledge base and its confidence in deploying DOD fuel cell systems.

There were other milestones achieved during this demonstration. The Ft. Belvoir AFB project was one of the earlier units to employ the Heliodyne heat exchanger which proved as reliable as other systems but at a fraction of the cost. For that reason, the project demonstrated that future fuel cell applications could readily and safely integrate more cost effective energy packages within the built environment as fuel cell services seek to become more commonplace within DOD and across America.

In achieving 92% operating availability, at an energy cost addition of less than \$700 dollars over incumbent utility services, this project can only be considered successful.

In sum, LOGAN believes that the Ft. Belvoir project achieved all of its programmatic objectives, that it has contributed to a greater understanding of fuel cell benefits within the DOD community, and that those lessons will apply equally to the broader objectives of the fuel cell industry and product commercialization.

18.0 Appendix

- 1) Cumulative Performance Data Charts
- 2) Monthly Performance Data Table
- 3) Power Electronics Harmonics testing
- 4) Daily Work Logs

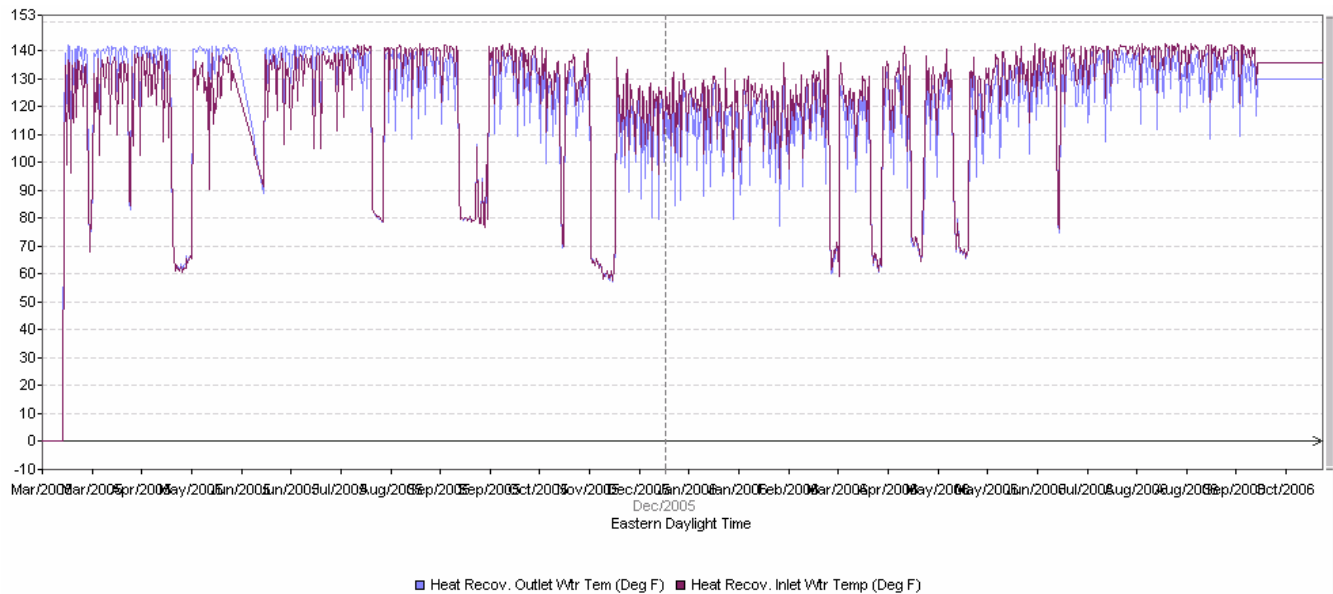


Figure 8, **Heat Recovery Inlet & Exit Temperatures** from March 2005 through October 2006

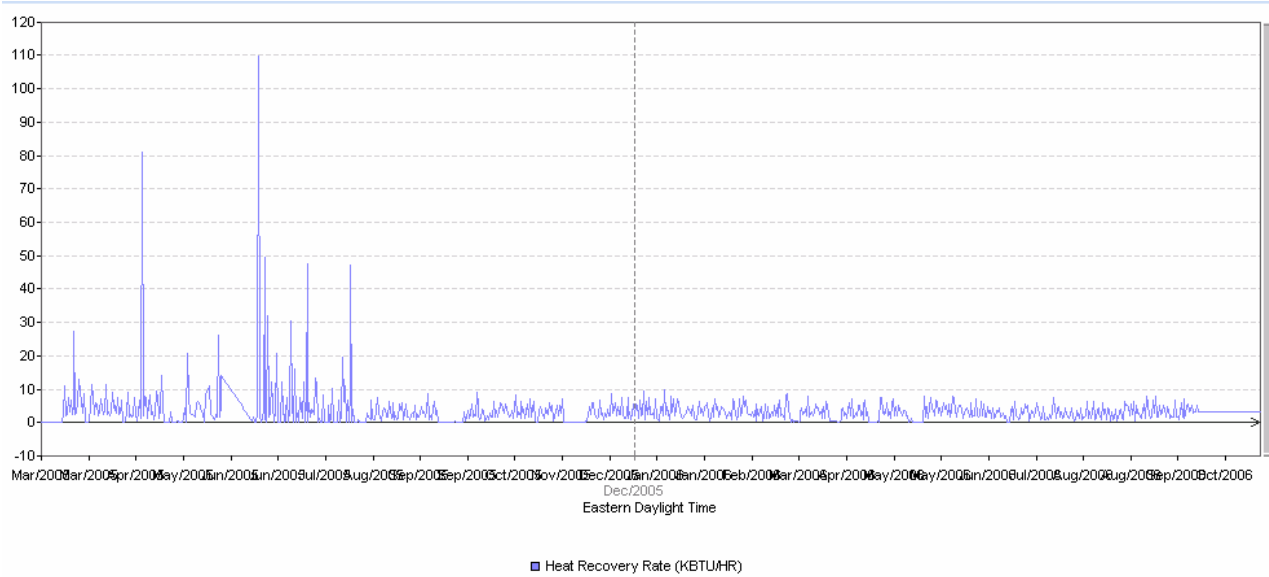


Figure 9, **Heat Recovery Rate in KBTU/hr.** from March 2005 through October 2006

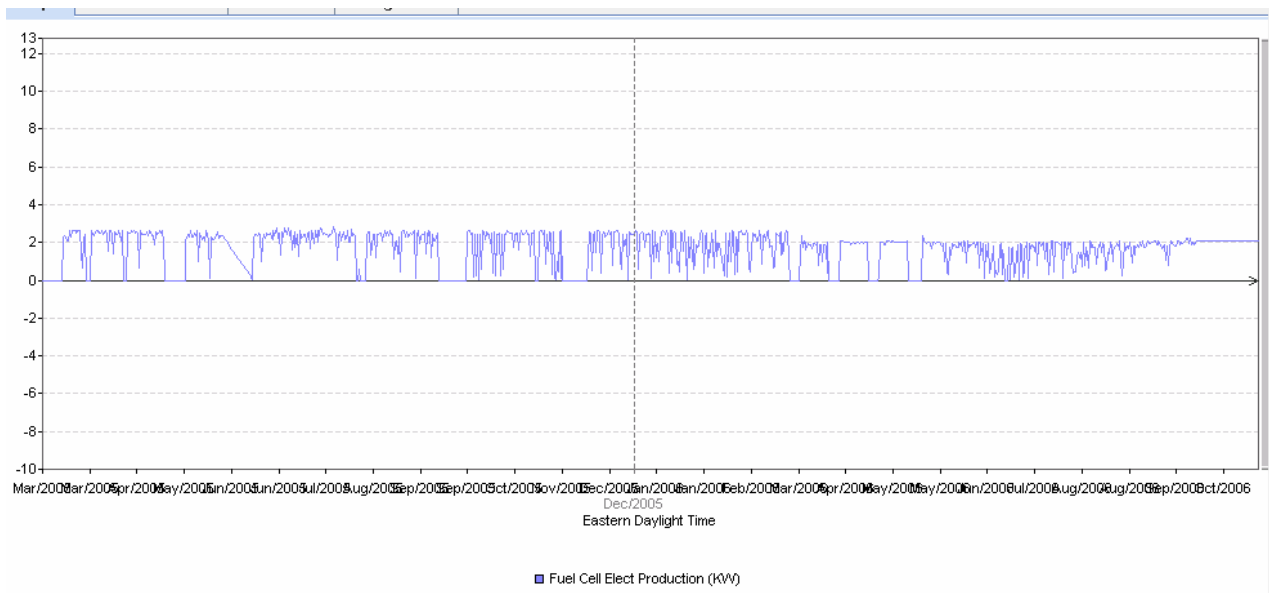


Figure 10, **AC Output Power in kW** from March 2005 through October 2006

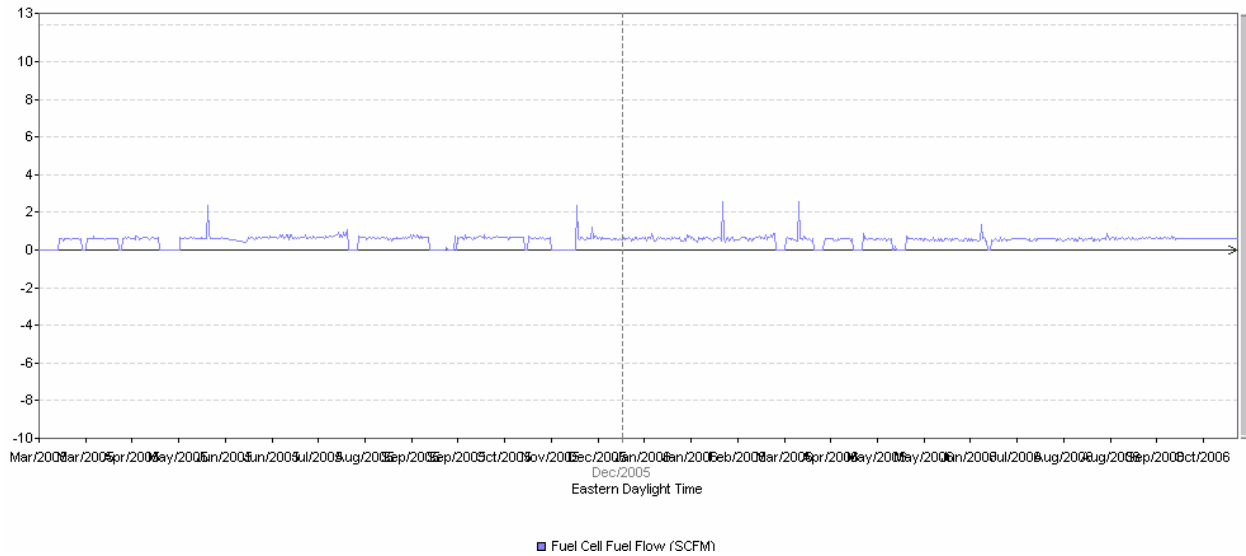


Figure 11, **Fuel Cell Fuel Flow (SCFM)** from March 2005 through October 2006

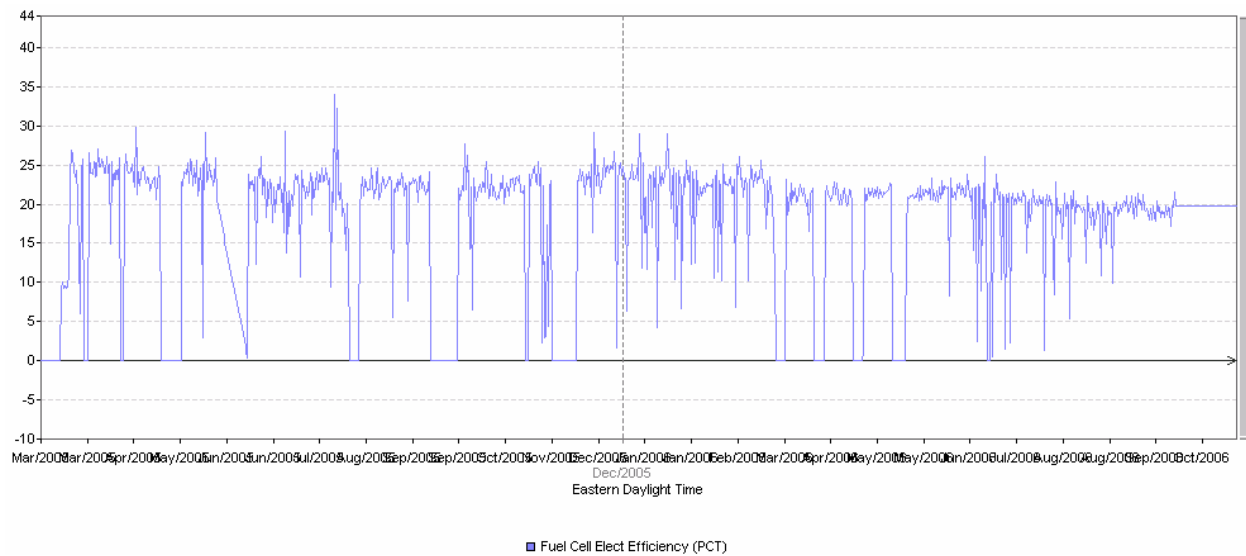


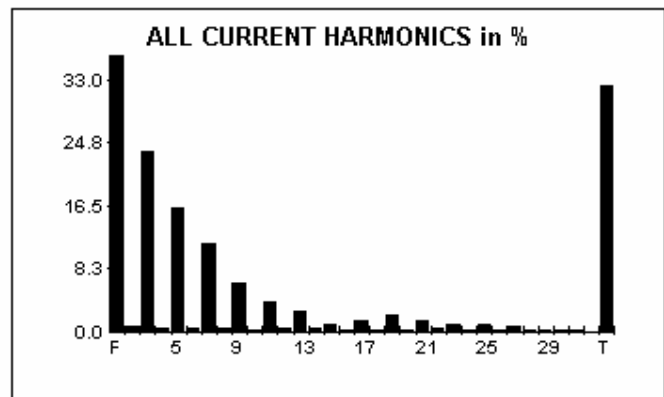
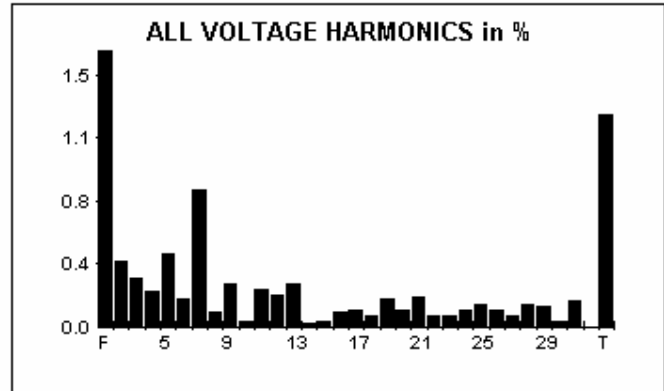
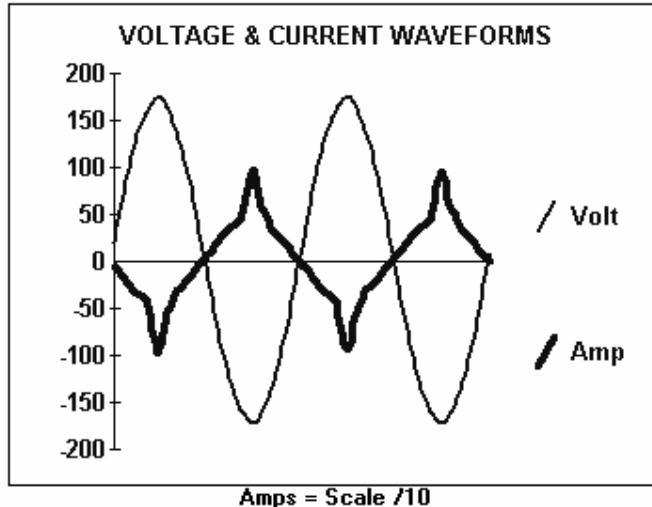
Figure 12, **Fuel Cell Electrical Efficiency (%)** from March 2005 through October 2006

2) Monthly Performance Data

Suggested Format for PEM Fuel Cell Performance Data																			
System Number:		SU01B000000323		Commission Date:		3/11/2005		Site Location(City,State): Fort Belvoir, Virginia											
Site Name:		Fort Belvoir		Fuel Cell Type:		Plug Power PEM													
Fuel Type:		Natural Gas		Maintenance Contractor:		LOGANEnergy Inc.													
Lower Heating Value:		943		BTU/scf		Local Residential Fuel Cost per Therm:		\$/Therm		Local Base Fuel Cost per Therm:		\$/Therm							
Capacity kW		5				Local Residential Electricity Cost per kWhr:		\$/kWhr		Local Base Electricity Cost per kWhr:		\$/kWhr							
Month	Run Time (Hours)	Time in Period (Hours)	Availability (%)	Energy Produced (kWe-hrs AC)	Output Setting (kW)	Average Output (kW)	Capacity Factor (%)	Fuel Usage, LHV (kWh)	Fuel Usage, LHV (BTUs)	Fuel Usage (SCF)	Electrical Efficiency (%)	Thermal Heat Recovery (BTUs)	Heat Recovery Rate (BTUs/hour)	Thermal Efficiency (%)	Overall Efficiency (%)	Number of Scheduled Outages	Scheduled Outage Hours	Number of Unscheduled Outages	Unscheduled Outage Hours
Insert month	insert operating hours	insert hours in month	*1	insert produced energy	insert output setting	*2	*3	insert fuel consumption			*4	insert heat recovery	*5	*6	*7	insert value	insert value	insert value	insert value
March, 2005	466	480	97%	1104.0	2.5	2.37	46.00%	4136	1.41E+07	13951	26.71%	2487460	5337.896996	17.63%	44.33%	0	0	1	14
April, 2005	679	720	94%	1626.0	2.5	2.39	45.17%	6104	2.08E+07	20589	26.65%	3475630	5118.748159	16.69%	43.34%	0	0	1	41
May, 2005	511	744	69%	1242.0	2.5	2.43	33.39%	4640	1.58E+07	15651	26.78%	4104770	8032.818004	25.93%	52.71%	0	0	1	233
June, 2005	702	720	98%	1634.0	2.5	2.33	45.39%	6626	2.26E+07	22357	24.67%	6946050	9894.65812	30.71%	55.38%	1	18	0	0
July, 2005	576	744	77%	1335.0	2.5	2.32	35.89%	5627	1.99E+07	19655	22.92%	7851050	13630.29514	39.49%	62.41%	0	0	1	168
August, 2005	580	744	78%	1376.0	2.5	2.37	36.99%	5131	1.75E+07	17307	26.83%	2074800	3577.241379	11.85%	38.68%	1	164	0	0
September, 2005	412	720	57%	902.0	2.5	2.19	25.06%	3943	1.35E+07	13300	22.89%	1330400	3229.126214	9.89%	32.78%	0	0	1	308
October, 2005	744	744	100%	1725.0	2.5	2.32	46.37%	7430	2.54E+07	25062	23.23%	2393600	3217.204301	9.44%	32.67%	0	0	0	0
November, 2005	484	720	67%	819.0	2.5	1.69	22.75%	3764	1.28E+07	12696	21.77%	1286000	2657.024793	10.01%	31.78%	0	0	1	236
December, 2005	744	744	100%	1637.0	2.5	2.20	44.01%	7611	2.60E+07	25673	21.52%	2668900	3587.231183	10.28%	31.80%	0	0	0	0
January, 2006	696	744	94%	1455.8	2.5	2.09	39.13%	7007	2.39E+07	23635	20.79%	2707800	3690.517241	11.33%	32.11%	0	0	1	48
February, 2006	672	672	100%	1364.9	2.5	2.03	40.62%	5696	1.94E+07	19213	23.98%	2373800	3532.440476	12.21%	36.19%	0	0	0	0
March, 2006	643	744	86%	1119.2	2.5	1.74	30.09%	5660	1.93E+07	19092	19.79%	2152100	3346.967341	11.14%	30.93%	0	0	1	101
April, 2006	582	720	81%	1055.7	2.5	1.81	29.33%	4435	1.51E+07	14960	23.82%	1747900	3003.264605	11.55%	35.37%	0	0	2	138
May, 2006	605	744	81%	1166.1	2.5	1.93	31.35%	5203	1.78E+07	17550	22.43%	1789269	2957.469421	10.08%	32.50%	0	0	1	139
June, 2006	705	720	98%	1114.4	2.5	1.58	30.96%	5967	2.04E+07	20127	18.69%	2123380	3011.886525	10.43%	29.12%	0	0	1	39
July, 2006	408	408	100%	608	2.5	1.49	29.80%	3396	1.16E+07	11455	17.91%	1120585	2746.531863	9.67%	27.58%	0	0	0	0
Running Totals																			
	Total Run Time	Total Hours in Period	Total Availability (%)	Total Energy Produced	Average Output Setting	Total Average Output (%)	Total Capacity Factor (%)	Total Fuel Usage	Total Fuel Usage	Total Fuel Usage	Average Electrical Efficiency (%)	Total Thermal Heat Recovery	Average Heat Recovery Rate	Average Thermal Efficiency (%)	Average Overall Efficiency (%)	Total Outages	Total Hours	Total Outages	Total Hours
	9096	10704	85%	19561.7	2.5	2.15	36.55%	83215	2.84E+08	280693	23.52%	45389529	4990.05376	15.99%	39.51%	2	182	11	1426

3) Power Electronics Harmonics Testing

Amprobe HarmonaLink II Power Waveform Analysis



POWER

Working Pwr 503.36 W
Reactive Pwr 16.56 VAR Lead
Apparent Pwr 528.12 VA
Displacement Pwr 158.94 dVA
True Power Factor .95 PF
Displacement PF 1.00 dPF

VOLTAGE ODD HARMONICS

H	%	RMS	Angle
1	100.0	121.50	+0
3	0.3	.34	+109
5	0.4	.53	+7
7	0.8	1.00	-172
9	0.3	.31	-98
11	0.2	.27	-123
13	0.3	.31	-116
15	0	0	
17	0	0	
19	0.2	.21	+129
21	0.2	.22	-91
23	0	0	
25	0.1	.16	-4
27	0	0	
29	0.1	.14	+144
31	0.2	.18	+111
Trip.	0.5	.62	
Odd	1.1	1.36	
Even	0.6	.70	
THD	1.3	1.53	

CURRENT ODD HARMONICS

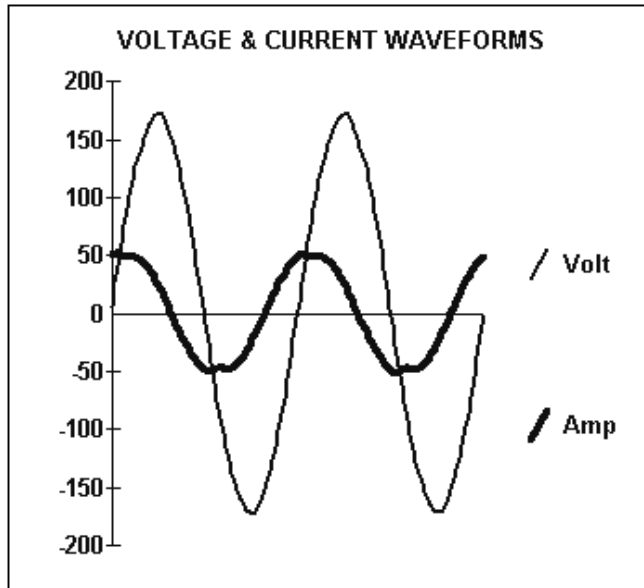
H	%	RMS	Angle
1	100.0	4.14	+0
3	23.7	.98	-173
5	16.2	.67	+17
7	11.6	.48	-148
9	6.2	.26	+58
11	3.9	.16	-96
13	2.7	.11	+94
15	1.0	.04	-125
17	1.5	.06	+41
19	2.2	.09	+178
21	1.3	.05	+30
23	1.0	.04	-133
25	0.9	.04	+118
27	0.6	.02	-40
29	0.2	.01	+160
31	0.2	.01	-174
Trip.	24.6	1.02	
Odd	32.1	1.33	
Even	1.3	.05	
THD	32.16	1.33	

TOTALS Voltage Current

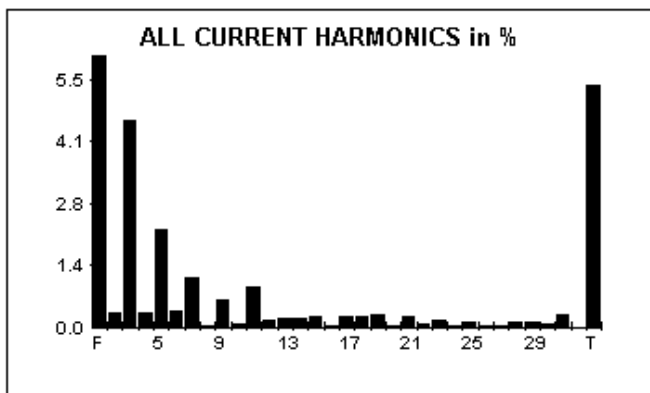
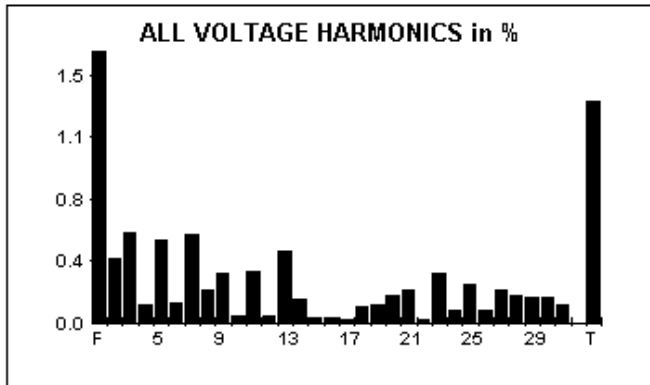
Total	121.51	4.35 rms
Peak	172.73	9.81
Avg.	109.34	3.51
DC	.15	.09
Crest	1.42	2.26
Form	1.11	1.24
F Freq	60.04	60.02 Hz
Fund.	121.50	4.14 rms
Harm.	1.53	1.33 rms
THD %	1.26	32.2%
K Fctr	1.02	3.56

TEST: Phase A on 06-10-05 @ 10:48 AM
Rec: 3,4 In File: C:\AMPROBE\MC2.DAT
Of: Grid Without Fuel Cell
Voltage Ref to: Ground

Amprobe HarmonaLink II Power Waveform Analysis



Working Pwr 2.22 KW
Reactive Pwr 3.92 KVAR Lead
Apparent Pwr 4.52 KVA
Displacement Pwr 232.97 dVA
True Power Factor .49 PF
Displacement PF .49 dPF



VOLTAGE ODD HARMONICS

H	%	RMS	Angle
1	100.0	120.73	+0
3	0.5	.65	+88
5	0.5	.61	-23
7	0.5	.65	-173
9	0.3	.36	-132
11	0.3	.38	-169
13	0.4	.52	-141
15	0	0	
17	0	0	
19	0.1	.13	+15
21	0.2	.24	-175
23	0.3	.36	-127
25	0.2	.28	-117
27	0.2	.24	-85
29	0.2	.19	-35
31	0.1	.12	-95
Trip.	0.7	.87	
Odd	1.2	1.47	
Even	0.6	.70	
THD	1.3	1.62	

CURRENT ODD HARMONICS

H	%	RMS	Angle
1	100.0	37.50	+0
3	4.6	1.72	+127
5	2.2	.82	+52
7	1.1	.41	+13
9	0.6	.23	-18
11	0.9	.33	-53
13	0.2	.08	-122
15	0.2	.09	-50
17	0.2	.09	+45
19	0.3	.10	-47
21	0.3	.09	+150
23	0.1	.05	-159
25	0.1	.05	+114
27	0	0	
29	0.1	.04	+103
31	0.3	.10	+109
Trip.	4.7	1.75	
Odd	5.3	2.00	
Even	0.7	.26	
THD	5.38	2.02	

TOTALS Voltage Current

Total	120.74	37.56 rms
Peak	171.83	51.81
Avg.	108.64	34.16
DC	.08	.65
Crest	1.42	1.38
Form	1.11	1.10
F Freq	60.02	60.02 Hz
Fund.	120.73	37.50 rms
Harm.	1.62	2.02 rms
THD %	1.34	5.4%
K Fctr	1.03	1.07

TEST: Phase A on 06-10-05 @ 10:37 AM
Rec: 1,2 In File:
C:\AMPROBE\MCENTRE.DAT
Of: Fuel Cell @ 5kW
Voltage Ref to: Ground

4) DAILY WORK LOGS
LOGANEnergy Field Technicians
October '03 – April '05

LOGANEnergy Corp.					
Monthly Site Report					
Period	October-03				
Site	Fort Belvoir				
Engineer	Date	PP S/N	Activity	Mileage	Hours
Harvell	9/30/2003	323			4.5
			Drove to Fredericksburg, VA.		
Harvell	10/1/2003	323			5
			Visited base with Spitznagel to find fuel cell site.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	September-04				
Site	Fort Belvoir				
Engineer	Date	PP S/N	Activity	Mileage	Hours
Harvell	9/22/2004	323			3
			Picked up water heater from Columbia.		
Harvell	9/23/2004	323			6
			Flew to Dulles and drove to Lorton.		
Harvell	9/24/2004	323		154	9.5
			Went to base early to meet trucker and rigging company. Trucker arrived around 11am. Unloaded fuel cell and flew back home.		
Harvell	9/27/2004	323			9.5
			Drove to Belvoir.		
Harvell	9/28/2004	323			12
			Worked with Jeff to install stack, put water heater in place, mount DI panel and CE box, make supply list and go shopping.		
Harvell	9/29/2004	323			10
			Mounted electric meter and disconnect, ran some of the conduit, soldered copper fittings on top of the water heater.		
Harvell	9/30/2004	323		1081	14
			Filled therminol, hung CL panel, ran PEX for the thermal loop, made list of supplies needed for next trip there, drove home.		

Worley	9/24/2004	323		NA	NA
			Purchase materials for meter install.		
Worley	9/27/2004	323		637	10
			Monday - Travel to site		
Worley	9/28/2004	323			10
			Tuesday - Went to base and began install work. Determined most efficient layout for electrical, communications, and mechanicals. Installed new hot water heater for CHP heat exchange. Made material list for conduit, tubing, etc. Went to Lowes and Home Depot to purchase materials.		
Worley	9/29/2004	323		33	8
			Wednesday - Returned to site and installed electric meter, disconnect, Connected Energy box, and some conduit. Also, began soldering fittings for CHP/water heater hook up.		
Worley	9/30/2004	323		333	11
			Installed critical load panel, began running CHP tubing, and continued work on conduit.		
Worley	10/1/2004	323		369	7
			Continued drive home. Stopped in Chattanooga, TN to pick up pipe fittings for gas meter tie in.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	October-04				
Site	Fort Belvoir				
Engineer	Date	PP S/N	Activity	Mileage	Hours
Harvell	10/4/2004	323			
			Continued installation work on fuel cell.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	March-05				
Site	Fort Belvoir				
Engineer	Date	PP S/N	Activity	Mileage	Hours
Harvell	3/10/2005	323			
			1110477168,3/10/2005 12:52:48 PM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1110477576,3/10/2005 12:59:36 PM,Manual (20)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		

			1110479638,3/10/2005 1:33:58 PM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1110479868,3/10/2005 1:37:48 PM,Manual (20)ALERT, PHONE_LINE1_BAD_MODEM_RESPONSE, Error Code: (120)(0)		
			1110479911,3/10/2005 1:38:31 PM,Manual (20)ALERT, PHONE_LINE1_PASSED, Error Code: (115)(0)		
			1110479957,3/10/2005 1:39:17 PM,Manual (20)ALERT, PHONE_LINE2_PASSED, Error Code: (123)(0)		
			1110480031,3/10/2005 1:40:31 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1110485967,3/10/2005 3:19:27 PM,Reformer Warmup (32)SHUTDOWN, TC13B_PROCESS_EXHAUST_HIGH_SD, Error Code: (333)(0)		
			1110485967,3/10/2005 3:19:27 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
Harvell	3/16/2005	323			
			1111007675,3/16/2005 4:14:35 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1111007675,3/16/2005 4:14:35 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111007824,3/16/2005 4:17:04 PM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1111008021,3/16/2005 4:20:21 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111010856,3/16/2005 5:07:36 PM,Running Warmup (50)ALERT, STACK_COOL_OUTLET_LOW_ALERT, Error Code: (236)(0)		
			1111509721,3/22/2005 11:42:01 AM,Running (51)SHUTDOWN, INVERTER_NOT_EXPORTING_AC, Error Code: (570)(0)		
Harvell	3/22/2005	323			
			1111509721,3/22/2005 11:42:01 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		

			1111512968,3/22/2005 12:36:08 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111513147,3/22/2005 12:39:07 PM,Reformer Purge (31)SHUTDOWN, SOL1_FUEL_VALVE_FAILED_CLOSED, Error Code: (623)(0)		
			1111513147,3/22/2005 12:39:07 PM,Unknown (100)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111513854,3/22/2005 12:50:54 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111518945,3/22/2005 2:15:45 PM,Running (51)SHUTDOWN, CATHODE_INLET_LOW_SD, Error Code: (205)(0)		
			1111518945,3/22/2005 2:15:45 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
Harvell	3/23/2005	323			
			1111585184,3/23/2005 8:39:44 AM,Manual (20)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1111585184,3/23/2005 8:39:44 AM,Manual (20)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1111588027,3/23/2005 9:27:07 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111591818,3/23/2005 10:30:18 AM,Reformer Warmup (32)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1111591823,3/23/2005 10:30:23 AM,Reformer Warmup (32)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1111591841,3/23/2005 10:30:41 AM,Reformer Warmup (32)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1111592752,3/23/2005 10:45:52 AM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1111592752,3/23/2005 10:45:52 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111592871,3/23/2005 10:47:51 AM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		


			1111592891,3/23/2005 10:48:11 AM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1111592922,3/23/2005 10:48:42 AM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1111594269,3/23/2005 11:11:09 AM,Manual (20)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1111594269,3/23/2005 11:11:09 AM,Manual (20)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
Harvell	3/24/2005	323			
			1111685617,3/24/2005 12:33:37 PM,ESTOP (107)ESTOP, HW_ESTOP_SARC_L0, Error Code: (534)(0)		
			1111686764,3/24/2005 12:52:44 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111692358,3/24/2005 2:25:58 PM,Reformer Warmup (32)SHUTDOWN, TC13B_PROCESS_EXHAUST_HIGH_SD, Error Code: (333)(0)		
			1111692358,3/24/2005 2:25:58 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111692473,3/24/2005 2:27:53 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1111692476,3/24/2005 2:27:56 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111696377,3/24/2005 3:32:57 PM,Running Warmup (50)SHUTDOWN, TC10_ATO_1_LOW_SD, Error Code: (310)(0)		
			1111696377,3/24/2005 3:32:57 PM,Unknown (100)SHUTDOWN, TC11_ATO_2_LOW_SD, Error Code: (315)(0)		
			1111696377,3/24/2005 3:32:57 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111696685,3/24/2005 3:38:05 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111697879,3/24/2005 3:57:59 PM,Reformer Warmup (32)SHUTDOWN, FS3_REFORMER_AIR_FLOW_LOW_SD, Error Code: (637)(0)		

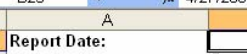
			1111697879,3/24/2005 3:57:59 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111698234,3/24/2005 4:03:54 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111701012,3/24/2005 4:50:12 PM,Running Warmup (50)SHUTDOWN, TC10_ATO_1_LOW_SD, Error Code: (310)(0)		
			1111701012,3/24/2005 4:50:12 PM,Unknown (100)SHUTDOWN, TC11_ATO_2_LOW_SD, Error Code: (315)(0)		
			1111701012,3/24/2005 4:50:12 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111704494,3/24/2005 5:48:14 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111706444,3/24/2005 6:20:44 PM,Reformer Warmup (32)ALERT, TIMEOUT_HUM_FILL, Error Code: (404)(0)		
			1111706963,3/24/2005 6:29:23 PM,Reformer Warmup (32)ALERT, TIMEOUT_HUM_FILL, Error Code: (404)(0)		
			1111706984,3/24/2005 6:29:44 PM,Reformer Warmup (32)ALERT, TIMEOUT_HUM_FILL, Error Code: (404)(0)		
			1111707012,3/24/2005 6:30:12 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1111707012,3/24/2005 6:30:12 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1111707106,3/24/2005 6:31:46 PM,SD Ref Cool (104)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1111707193,3/24/2005 6:33:13 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111712206,3/24/2005 7:56:46 PM,Running Warmup (50)SHUTDOWN, TC10_ATO_1_LOW_SD, Error Code: (310)(0)		
			1111712206,3/24/2005 7:56:46 PM,Unknown (100)SHUTDOWN, TC11_ATO_2_LOW_SD, Error Code: (315)(0)		
			1111712206,3/24/2005 7:56:46 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
Harvell	3/28/2005	323	Inverter Malfunction		

			Spent the first morning at the site trying to reset the inverter, which would reset less than half the times I tried. It was causing a loss of CL in the fire station, cutting off lights, copy machines, etc. Received a new one the next day. Installed it, but had a wire landed wrong, so that caused shutdowns for a few hours till it was "discovered". Also installed new retrofit for the DI polisher.		
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LOGANEnergy Corp.					
Monthly Site Report					
Period	April-05				
Site	Fort Belvoir				
Engineer	Date	PP S/N	Activity	Mileage	Hours
Worley	4/1/2005	323			
			1112395277,4/1/2005 5:41:17 PM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
			1112459313,4/2/2005 11:28:33 AM,Running (51)ALERT, FS3_REFORMER_AIR_FLOW_OUT_OF_RANGE, Error Code: (638)(0)		
			1112581096,4/3/2005 10:18:16 PM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
			1112807268,4/6/2005 1:07:48 PM,Running (51)ALERT, FS3_REFORMER_AIR_FLOW_OUT_OF_RANGE, Error Code: (638)(0)		
			1112880944,4/7/2005 9:35:44 AM,Running (51)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1112967344,4/8/2005 9:35:44 AM,Running (51)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1113053744,4/9/2005 9:35:44 AM,Running (51)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1113140143,4/10/2005 9:35:43 AM,Running (51)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1113176679,4/10/2005 7:44:39 PM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1113176679,4/10/2005 7:44:39 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1113176796,4/10/2005 7:46:36 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		

			1113176799,4/10/2005 7:46:39 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1113226543,4/11/2005 9:35:43 AM,Shutdown Complete (105)ALERT, ABORT_DATA_TRANSFER, Error Code: (131)(0)		
			1113305639,4/12/2005 7:33:59 AM,Shutdown Complete (105)ALERT, PHONE_LINE1_TIMEOUT, Error Code: (116)(0)		
			1113305902,4/12/2005 7:38:22 AM,Manual (20)ALERT, PHONE_LINE1_BAD_MODEM_RESPONSE, Error Code: (120)(0)		
			1113305945,4/12/2005 7:39:05 AM,Manual (20)ALERT, PHONE_LINE1_PASSED, Error Code: (115)(0)		
			1113305990,4/12/2005 7:39:50 AM,Manual (20)ALERT, PHONE_LINE2_PASSED, Error Code: (123)(0)		
			1113308383,4/12/2005 8:19:43 AM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1113308860,4/12/2005 8:27:40 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1113421843,4/13/2005 3:50:43 PM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1113421843,4/13/2005 3:50:43 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		

Logan Energy Remote Web Workplace		Microsoft Windows Small Business Server 2003	
Log Off B23 Main Menu 4/27/2007		Thursday, May 10, 2007	
 LOGANEnergy <small>The power of fuel cells.</small>		Incident Report/Work Log Ft Belvoir	
Report Date:	7/7/2006	Technician Initials:	MJH
Event:	E-wheel failure	FC Serial #:	323
Total Hours On-Site:	30		
Mileage:	1080		
Type of Outage:	<input type="checkbox"/> Scheduled <input checked="" type="checkbox"/> Unscheduled	Meter Readings: Gas 3611000 Electric 20543 BTU FC Operating Hours	
Failure Date/Time:	6/27/06 1:23		
Restart Date/Time:	6/28/06 17:00		
Total Hours Unavailable:	39		
Problem Description:	Stack weakness resulting from poor e-wheel performance		
Service Performed or Corrective Action Taken:	Changed e-wheel. Start-up resulted in a myriad of Press5 and Sol1 issues. Raised gas		

Logan Energy Remote Web Workplace		Microsoft Windows Small Business Server 2003	
Log Off B23 Main Menu 4/27/2007		Thursday, May 10, 2007	
 LOGANEnergy <small>The power of fuel cells.</small>		Incident Report/Work Log	
Report Date:	4/27/2007	Technician Initials:	MJH
Event:	Decommission	FC Serial #:	323
Total Hours On-Site:	35 incl driving		
Mileage:	1077		
Type of Outage:	<input type="checkbox"/> Scheduled <input type="checkbox"/> Unscheduled	Meter Readings: Gas Electric BTU FC Operating Hours	
Failure Date/Time:	N/A		
Restart Date/Time:			
Total Hours Unavailable:	#VALUE!		
Problem Description:	Decommission		
Service Performed or Corrective Action Taken:	Decommission		